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ADAPTER MEANS FOR AN UNDERWATER PROJECTILE

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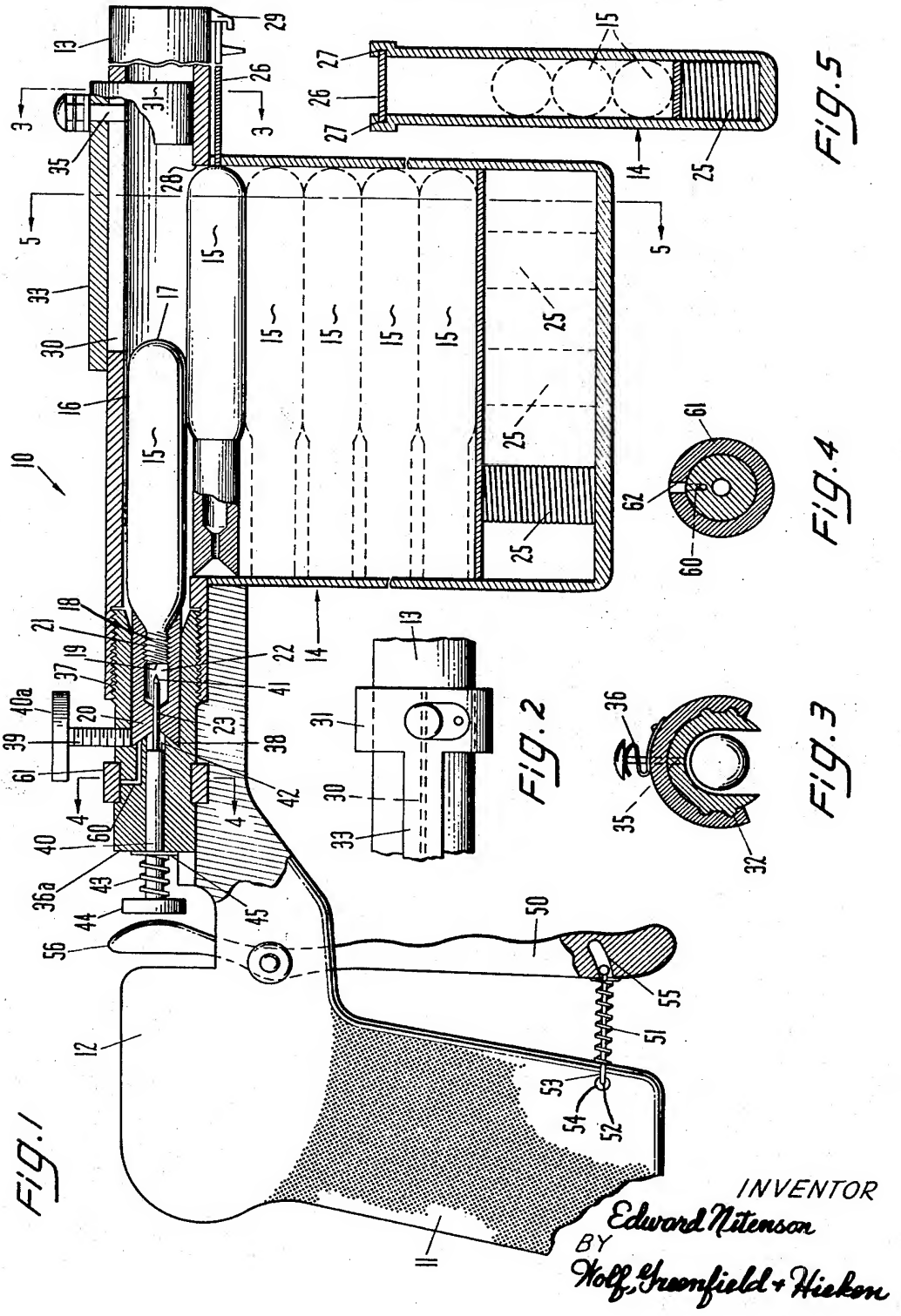

FIG. 1

FIG. 2

FIG. 3

FIG. 4

FIG. 5

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ABSTRACT OF THE DISCLOSURE

An underwater projectile is provided comprising an elongated hollow casing with a gas contianed within the casing. A rear wall of the casing defines a preselected area for penetration and means are located in association with the preselected area for uniformly discharging gases from the casing when the preselected area is punctured. An underwater gun is provided having means for frictionally engaging the projectile in the barrel and means for piercing an area of the projectile to permit uniform gas escape therefrom. Magazines are mounted on the barrel for feeding a series of projectiles to the barrel.

Underwater guns have been known to the art for many years. The launching and firing force for known projectiles fired by such guns are often derived from spring constructions, gas pressure chambers, pressure filled projectiles, ignitable chemical propellants and the like. Perhaps due to the nature of the water environment in which such guns are fired, it has been extremely difficult to devise a gun and projectile which permits high accuracy and precision. The projectiles of known construction are subject to unwanted fluctuations over their path of travel and do not tend to follow a substantially straight linear course.

The prior art has suggested the use of fins and various hydrodynamic guiding means incorporated on the projectiles to guide their movement over straight lines and provide for accuracy in hitting targets at long distances. However, such means often add to the weight and cost of the projectiles. Moreover, known constructions have not achieved accuracy and precision particularly where projectiles are fired for distances of twenty feet or more.

It has now been found that variations from a desired path of a projectile of the gas pressure filled type, are often due to variations in gas flow patterns from a punctured orifice of a gas filled projectile. Commonly gas filled projectiles are merely punctured by a punching action leaving a jagged rear hole through which gas escapes to propel the projectile. The jagged hole is inherent in known constructions since the punching action cannot produce a perfectly round uniform cross section opening. Nonuniform gas flow from the projectiles causes erratic motion and at least slight fluctuations of the projectiles from straight line paths tending to increase water turbulence and resistance thus slowing down such projectiles and altering their course in flight.

Another disadvantage of known underwater gun constructions is their conventional single shot action. Such constructions require manual loading of each projectile which is time consuming and can be extremely dangerous when such guns are used as shark repellents or in hunting various sea forms.

An important object of this invention is to provide a means for precisely propelling a projectile underwater along a predetermined path.

Another important object of this invention is to provide a means in accordance with the preceding object comprising a projectile which is inexpensive yet extremely accurate.

Still another important object of this invention is to

provide a means in accordance with the preceding objects which is capable of rapidly firing a series of projectiles semi-automatically.

According to the invention, an underwater projectile comprises an elongated hollow casing containing an expansible propellant within the casing. A rear wall of the casing defines a preselected area for penetration of the casing to release the gas and thereby cause propulsion of the projectile. Means are located in association with the preselected area for uniformly discharging gases from the casing when the preselected area is punctured. The uniform flow of gases from the casing is extremely important to avoid unwanted fluctuation during the path travel of the projectile and maintain the projectile along a linear path to achieve high target accuracy. Preferably the means provides a circular discharge orifice located behind the area to be punctured and preferably with a small expansion chamber therebetween.

The underwater gun of this invention useful for firing a series of gas-filled projectiles as previously described comprises an elongated barrel constructed and arranged to snugly receive an elongated projectile. Means are provided for frictionally engaging a projectile in the barrel and another means acts as a firing mechanism for piercing the preselected area of the projectile to permit gas escape. A magazine means is mounted on the barrel for feeding a series of projectiles thereto and a means is preferably located in the barrel for positioning each projectile in the barrel in proper firing position after feeding from the magazine.

It is a feature of this invention that the rapid reloading by means of a magazine and the accurate path of travel of the projectile render the means of this invention particularly useful as a shark repelling device. Thus, a series of missiles can be accurately fired in succession to drive off sharks underwater. The projectiles can also be used with suitably designed configurations for underwater fishing.

The above and other objects, features and advantages of the invention will be better understood from the following specification when read in connection with the accompanying drawings in which:

FIG. 1 is a side view partially in cross section of an underwater gun and projectile in accordance with the preferred embodiment of this invention;

FIG. 2 is a top view of a portion thereof;

FIG. 3 is a cross sectional view through line 3—3 thereof;

FIG. 4 is a cross sectional view through line 4—4 thereof; and

FIG. 5 is a cross sectional view through line 5—5 thereof.

Turning now to the drawings, an underwear gun in accordance with this invention is illustrated generally at **10** in FIG. 1 and comprises a hand grip **11** forming a portion of stock **12** to which is attached a cylindrical barrel **13** having a detachable magazine clip **14** carrying a plurality of projectiles **15**.

The projectiles **15** are preferably specially designed and form an important part of the present invention. These projectiles comprise a conventional elongated cylindrical casing **16** having a blunt rounded forward end **17** and a tapered threaded rear end **18**. A rear area **19** at the tip of the threaded end **18** acts as a preselected area which can be punctured to release compressed gases contained within the hollow casing **16**.

Casings such as **16** are conventionally used in spear fishing guns and are readily available. One particular type of casing **16** eminently suitable for use in the present invention is known as U.S. Diver's Cartridge and has an outside diameter of about 0.744", a length of about 3¼" and contains a compressed gas having a pressure of about

850 pounds per square inch at 70° F. and an over-all weight of about 2 ounces.

Attached to the rear end of the casing **16** is an adapter **20** comprising a cylindrical section defining a threaded end **21** threadably engaged with end **18** and a generally cylindrical elongated expansion chamber **22**. Beyond the expansion chamber **22** leading to the extreme rear of the adapter **20** is a circular bore **23** providing a uniform elongated passageway and defining an orifice at the extreme end of the adapter having a circular configuration coaxial with the longitudinal axis of the projectile **15**. As can readily be seen from the drawing, when the preselected area **19** is punctured, gases escape from the casing **16** into the expansion chamber **22** and are funneled out of the passageway **23** and rear orifice through a circular opening providing for a uniform escape of the gases, i.e., the expansion of the gases beyond the end orifice and flow from the end orifice follows a circular cross section symmetrical about the longitudinal axis of the casing and symmetrical about the linear path of travel of the projectile. It has been found that merely puncturing the preselected area can never provide a uniform symmetrical orifice providing for uniform flow. Thus, if no adapter is used and the end area **19** punctured, variations in symmetry of flow of the gases from the chamber cause fluctuation during the flight path of the cartridge. On the other hand, when a symmetrical orifice end opening is used, the uniform flow pattern is instrumental in providing for elimination of fluctuation and straight line movement of the casing **16** along its trajectory path.

While a preferred embodiment of the adapter **20** is illustrated and described, many modifications can be made therein. For example, it is only necessary to provide for uniform escape of the gas at the extreme end of the projectile by the use of a symmetrical balanced opening about the axis of the projectile. Preferably the opening has an area no greater than that of a circle of ⅛" diameter. Thus, star-shaped symmetrical openings, or other shaped openings can be used. In some cases, the expansion chamber **22** can be eliminated or changed in configuration. Similarly, the screw thread means can be substituted with any known attachment means or the orifice end can be fabricated directly on the casing **16** beyond the preselected area **19**.

In addition to variations in the adapter, the casing **16** can be modified as desired. It is preferred that the casing be no longer than 7" in length to maximize efficiency in small hand-held gun arrangements. The blunted end **17** can be pointed or otherwise shaped to adapt it for fishing if desired. The blunted end can be provided with an attached explosive head for exploding on contact. It is unnecessary to use guidance fins in view of the hydrodynamically-shaped casing symmetrical about its longitudinal axis although such fins may be provided if desired. It should be understood that even the blunted end projectile described above provides sufficient force to deter a shark at a distance at least as great as 20 feet.

A plurality of projectiles **15** are preferably carried in a conventional spring loaded magazine **14** for semi-automatic feeding to the gun barrel **13**. The magazine **14** is preferably generally rectangular having a spring pusher section **25** constantly urging the projectiles upwardly. A flat slide plate **26** is provided fitting in notches **27**. The plate **26** covers the projectiles and maintains them in place before attachment of the magazine to the gun **110**. When the magazine is clipped to the gun barrel underlying a slot **28**, by conventional attachment means not shown, the plate **26** is slid forwardly to a forward bracket **29** during use of the magazine allowing projectiles **15** to be pushed upwardly into the barrel directly above the magazine.

The gun barrel **13** is provided with a slot **30** and a split ring **31** overlying the slot. Split ring **31** is suitably located for axial sliding by projections and notches **32** as best shown in FIG. 3. The ring **31** has an extension portion **33** fully covering the slot **30** when the ring is positioned in its

forward position as shown in FIG. 1. Covering of the slot prevents water and gas escape which could be detrimental to the path of the projectile. The ring **31** carries a downwardly extending pin **35** spring loaded by coil spring **36** to its upper position.

In use, when a cartridge **15** is automatically positioned within the barrel **13**, the ring **31** is slid to its forward position, pin **35** depressed engaging the forward end **17** of the projectile. Movement of the pin rearwardly by the hand moves the projectile rearwardly into its firing position as will be described.

The firing mechanism of the gun **10** comprises a cylindrical member **36***a* attached to the rear end of the barrel **13** as by screw threads **37**. Barrel **13** and member **36***a* are attached to the stock **12** by conventional means such as bolts not shown. Member **36***a* has an axially aligned adapter receiving section **38** and carries a threaded shank **39** adapted to be screwed down by handle **40** into frictional engagement with the tip of the adapter as best shown in FIG. 1. The shank **39** holds the projectile in a frictional fit within the barrel and preferably exerts just enough pressure to maintain the projectile in place while piercing of the preselected area **19** is carried out by a firing pin **40**.

The firing pin **40** is axially algned wth the barrel and member **36***a* and comprises a pointed end **41** for piercing of the wall **19** to a preselected depth whereupon the shoulder **42** meets with the end of the adapter section urging the adapter towards the opened end of the barrel overcoming the frictional force applied by the shank **39**.

The pin **40** is slidably mounted for reciprocation along the axis of the gun barrel by a coil spring **43** abutting a stop **44** and fixation collar **45** which is in turn attached to the member **36***a*. Thus, the spring **43** constantly urges the firing pin to the position shown in FIG. 1.

The hand grip **11** carries an actuator **50** which is spring loaded by spring **51** about pivot pin **52** to the position shown in FIG. 1. Preferably within the spring **51** is a shaft **53** having one end pivoted to the hand grip at **54** and a second end slidable within a suitable groove **55** in the actuator or trigger **50**. Upon gripping of the actuator **50** and rapid pulling toward the handle by the hand of a user, the firing end **56** contacts the stop **44** and rapidly pushes the pin **40** to its piercing position.

A bore **60** is provided in the member **36***a* permitting communication between the end of the barrel and the outside. The outside end of the bore is covered by a circumferentially rotatable slip ring **61** having a bore **62** therein adapted to mate with bore **60** upon rotation to the position shown in FIG. 4. Upon rotation out of the position shown in FIG. 4, bore **62** is displaced to the side and bore **60** covered substantially preventing communication between the outside and the barrel end. Slip ring **61** is adjusted to the position shown in FIG. 4 when pin **35** is used to move a projectile rearwardly. Thus, during this movement, passageway **60** allows expulsion of water within the barrel. When the projectile is in its firing position and during firing, the slip ring **61** is rotated to close the passageway **60**. Closing of the passageway **60** has been found extremely desirable to concentrate the expanding gases within the gun barrel during launching or firing and thereby add substantial momentum to the flight of the projectile.

Turning now to the method of operation of a preferred embodiment of this invention, the gun barrel **13** has an inside diameter of approximately 0.750 inch and a length of about 14 inches. A 2-ounce U.S. Diver's Cartridge as previously described, having a length of about 3¼ inches and a diameter of about 0.744 inch was used with an adapter ¾ inch long having a passageway 23¼ inch long with a uniform diameter of 1/16 inch. Expansion chamber **22** is ¼ inch long and has a diameter of ⅛ inch. A magazine clip **14** containing six cartridges was placed in position on the gun barrel and the slide plate **26** pushed forwardly to engage the bracket

29 allowing a cartridge to be automatically positioned in the barrel. Pin 35 was depressed and moved rearwardly to locate a projectile in the position shown in FIG. 1 with ring 61 suitably positioned. The firing pin was actuated by the actuator 50 to provide a hole of about 1/16 inch diameter in the preselected area 19. Immediately upon actuation of the firing pin to cut the hole, the projectile 15 was pushed out of frictional engagement with the shank 39 and launched from the gun barrel by the expanding gas covering 20 feet underwater in about 3 seconds alonng a substantially straight line path to hit a target with substantial force sufficient to stun a shark. As the first projectile left the gun barrel, a second projectile 15 was positioned therein and the launching operation repeated until each of the cartridges were rapidly and accurately fired.

While specific embodiments of this invention have been shown and described, it will be obvious to those skilled in the art that many modifications thereof are possible. For example, the firing pin arrangement for firing the cartridge can vary greatly. In some cases, the firing pin will be preloaded by a spring or other means in the forward direction rather than the rearward direction. Thus, upon tripping of a suitable lever, the spring or other means will add substantial force to the firing pin enabling substantially instantaneous piercing of the preselected area. Similarly, the member 36*a* may take other forms. In all cases, it is desirable to use a magazine feed for rapid firing of a series of projectiles.

The frictional means vary vary. In some cases, the diameter of the casing 16 can be dimensioned to provide for frictional engagement of the casing with a preselected area of the gun barrel and thus enable elimination of the frictional means 39. Similarly, the means for locating the projectile adjacent the firing mechanism can be varied and in some cases member 36*a* can be slid into engagement with the projectile rather than vice versa.

The means of attachment of the adapter can vary. Thus, a force fit joint can be used in place of a screw thread.

The size of the hole formed by the firing pin 41 can vary depending upon the distance of travel desired and the force at a given distance desired. Thus, a large hole

provides faster travel over a shorter distance than a small hole. Similarly, variation in the diameter of end orifice 23 will affect speed and distance. If desired, the firing pin can be made adjustable to provide predetermined travel of its point to form a desired size opening. In all cases, the projectile does not move until the shoulder of the firing pin pushes it past the friction holding means.

In view of the many modifications possible, this invention is to be limited only by the spirit and scope of the appended claims.

What is claimed is:

1. An underwater projectile comprising an elongated hollow casing,
   - an expandable propellant gas contained within said casing,
   - a rear wall of said casing defining a preselected area for penetration of said casing to release said gas,
   - an adapter defining a passageway with an end opening axially aligned with the axis of said casing,
   - said passageway defining an expansion chamber for said gas prior to discharge of said gas from said end opening whereby said gas can be uniformly discharged from said casing when said preselected area is punctured by entrance of a puncturing means into said passageway and said preselected area.

2. An underwater projectile in accordance with claim 1 wherein said passageway is provided aligned with said preselected area and said passageway defines said end opening symmetrical about the axis of said casing having an area no greater than that of a circle having a diameter no greater than about 1/8 inch.

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